Idaho National Engineering and Environmental Laboratory

Deactivation and Decommissioning Focus Area, Ohio Field Office, Fernald Environmental Management Project, Fernald Ohio

An Integrated Excavation Control System

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What is Integrated Excavation Control System (IECS)?

- *A suite of real-time technologies used to manage near-simultaneous characterization of excavation activity at Fernald's Production Area and Waste Pit Area*

- *IECS real-time systems consist of hardware, sensor, software, and positioning technology*

- *Two primary technologies are:*
  - *Excavation Monitoring System (engineered and built by INEEL)*
  - *Gator*

Excavation Monitoring System Description

- *EMS is of modular construction*

EMS Description (cont.)

- *System is a self-contained gamma-detection system that scans excavation floor*

EMS Description (cont.)

- *Deployed from standard tracked-excavator boom*

EMS Description (cont.)

- *Excavator operator is guided by visual display of operating conditions:*
  - *detector speed*
  - *proximity to surface*
  - *proximity to trench side-walls*
- *Display provides visual and collision-avoidance alarms for operator*

EMS Description (cont.)

- *Platform assembly houses system integration package:*
  - *Excavator-to-platform coupler*
  - *Onboard computer*
  - *GPS receiver and antenna (positioning)*
  - *Alternative Laser tracking system (localized positioning)*

EMS Description (cont.)

- *System controlled from remote van workstation*

- *System integrates:*
  - *EMS platform functions*
  - *excavator operator monitor and alarm system*
  - *data analysis software*
  - *real-time mapping/display*
  - *data validation*

IECS Survey-grade GPS technology

- *Survey-grade GPS technology deployed on current large-area-scanning platform: "Gator"*
- *Will be applied to the problem of rapid and accurate estimation of excavation volumes*

IECS Survey-grade GPS technology (cont.)

- *Survey-grade GPS units were tested along with the EMS during the testing periods in June and December 2001*
- *Work has been done to develop topographical mapping capabilities using the GPS systems on Gator all-terrain vehicle*
- *Capability extended to calculation of excavated soil volumes on basis of topographic data*
- *Mapping and volume estimating capability integrated into the real-time radiological characterization process as part of the IECS*

FEMP IECS Goals

- *Fernald to begin Production Area remediation phase involving Integrated Excavation Control System (IECS) technology in Spring FY-2002*

- *Characterize soils in at-or-below-grade portions of structures within Production Area*

- *IECS utilize real-time characterization of large-area soil areas cleanup at Fernald to:*
  - *reduce human exposure to health risks*
  - *reduce remediation operating costs*
  - *accelerate cleanup process where possible*

FEMP IECS Goals (cont.)

- *Expand and enhance the FEMP's capabilities for in-situ measurement of radionuclide concentrations in soils*

- *Allow estimates of excavated soil volumes to be made rapidly, and*

- *Minimize radioactive wastes generated during soil excavation*

IECS Technical Approach

- *IECS technology, Excavation Monitoring System (EMS), will be deployed in Production Area to perform Excavation Control Surveys (ECS) for OSDF above-WAC soils*
- *As surface soil is removed, freshly exposed soil is scanned with the EMS*

IECS Technical Approach (cont.)

- *EMS utilizes NaI detector to scan survey area to determine spatial extent of contamination and detect and delineate areas of activity above WAC in real-time (for transfer to On-Site Storage Facility*
- *Hotspot characterization performed using NaI/HPGe detectors*
- *Waste Acceptance Criteria (WAC) volume of soil requiring disposal (~38,000yd^3) reduced by 20% using IECS approach*
- *Approach requires that EMS provide:*
  - *location*
  - *spatial extent*
  - *concentrations of contaminants*

Technical Approach (cont.)

- *Integrated Excavation Control System (IECS) concept addresses Fernald Production and Waste Pit Areas needs to enhance management of at-or-below grade D&D structure removal and associated soils remediation*

- *With acquisition of the real-time in situ measurement technology, FEMP replaces baseline "representative" sampling techniques that require human interaction with potentially high hazard risk environments associated with excavation of foundations, pits and trenches.*

Primary Contaminants of Concern

- *Efficiently characterize Primary Contaminants of Concern (COC) that account for 90% of the health risk from soil at the site are (Source, Site Excavation Plan, 1997):*

COC	Free Release Levels (FRLs)
– total uranium	82 ppm
– thorium-232	1.5 pCi/g
– radium-226	1.7 pCi/g
– radium-228	1.8 pCi/g
– thorium-228	1.7pCi/g

Technical Maturity of IECS

- *Both EMS and Gator are significantly improved prototype systems*
- *EMS predecessor called Warthog (EM-50 funded development). Gator and RTRAK originated mobile, NaI-based scanning at the FEMP*
- *Warthog demonstrated at MEMP, FEMP, UKAEA*
- *RTRAK originally used at Rocky Flats for large area soil scanning*
- *Scanning systems have matured to "robust" field systems*

Technology/Project Support

- *No system can be "taken out of the carton" and utilized without a baseline of technical support*
- *FEMP has developed a comprehensive, dedicated support team made up of FEMP, INEEL, ANL, and EML expertise*
- *Dedicated FEMP support structure ensures continuity in project cost-saving and risk reduction goals*
- *Thrust 1 outlines "multi-disciplinary, hands-on, committed" team concept which already exists at FEMP*
- *Continued execution of Thrust 1 priorities at FEMP require only financial underpinning, process already in place*

Technology/Project Support (cont.)

- *FEMP is in the process of realizing a 10:1 ROI for the deployment of the "Integrated Technology Suite for Cost-Effectively Delineating Contamination in Support of Remedial Actions" to reduce High Risk/High Cost baseline strategies at Fernald (Thrust 2)*

- *An "aggressive investment strategy" is logical given that FEMP has an effective and measurable process in place; where additional funds are specifically and efficiently targeted at relatively low-risk/high payoff outcomes*

Meeting Schedule Requirements (cleanup by 2006)

- *To date development of IECS technology has occurred on time and budget to meet accelerated baseline schedule requirements for soils and Production Area remediation activity*

- *EMS will be used in Production Area in Spring 2002 remediation activities as primary IECS tool*

Benefits

- *Estimated cost savings using IECS: $5,400K*
- *Dramatically reduces or eliminates human interaction with potentially high hazard risk environments*
- *Baseline sampling technique would require physical samples be taken during field screening -these are eliminated*
- *Construction safety issues, i.e. excavation slopes, fall hazards etc., are significantly reduced by removing RCT personnel from excavation settings*

Benefits (cont.)

- *Technology Safety Data Sheet will be available in Spring 2002*

- *OSHA requirements were considered in EMS design:*
  - *lightweight modules*
  - *elimination of electrical shock hazard*
  - *ease of use*

- *Use of IECS creates no secondary waste stream*

Benefits (cont.)

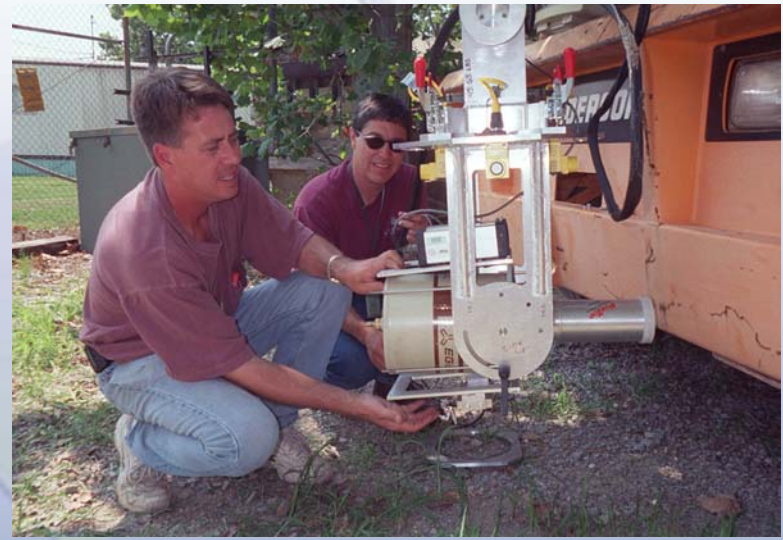
- *FEMP is supported by a diverse team from INEEL, EML, ANL where elapsed time from defining design requirements to field deployment are separated by few months and few dollars (Thrust 1)*
- *Technical support from team contributors is not subordinated to external factors such a local site deliverables*
- *IECS technology brought from prototype to field ready status at relatively low cost and in a few months where risk to High Risk/High Cost Baselines have been significantly reduced or eliminated (Thrust 2)*
- *IECS has become new baseline technology*

Technical Progress

- *IECS EMS requirements finalized January 2001, system delivered to FEMP site (from INEEL) in June 2001*
- *EMS acceptance trials were successful, identified minor modifications to EMS and system software executables*
- *Completed necessary regulatory documentation and Operator's manuals*
- *Conducted real-time technology demonstration at Oak Ridge during the week of July 9, 2001 for the benefit of the site contractor, involved regulators, and other stakeholders*

Technical Progress (cont.)

- *EMS acceptance trials June 2001*



Technical Progress (cont.)

- *Assembled ASTD partners for final acceptance testing and system calibration of the EMS during the week of December 3, 2001*

- *Prepared a draft First Year Summary Report for the IECS*

- *Technical results enable FEMP to continue soils clean-up in Production Area on schedule while exemplifying content of both Thrusts by having the technology, support team, desired risk levels, converted baseline and high quality attributes already in place*

Technical Progress (cont.)

- *Calibration of EMS with detectors on FEMP calibration pad in December 2001*

Technical Progress (cont.)

- *Interest has been expressed by MEMP to utilize a variant of the system in the near future*
- *Private industry has expressed interest in non-radioactive application of the system in construction settings*
- *A private industry concern has expressed interest in intellectual property for potential system variations, enhancements etc.*